Name: _____ **Sample Solution** _____

Email address (UW NetID): _____

CSE 160 Winter 2020: Midterm Exam

(closed book, closed notes, no calculators)

Instructions: This exam is closed book, closed notes. You have 50 minutes to complete it. It contains 10 questions and 9 pages (including this one), totaling 100 points. Before you start, please check your copy to make sure it is complete. Turn in all 9 pages of the exam, together, when you are finished. When time has been called you must put down your pencil and stop writing. A syntax sheet will be provided separately. **Points will be deducted from your score if you are writing after time has been called.** You should only use parts of Python that have been covered in the class so far.

Good Luck! Total: 100 points. Time: 50 minutes.

Problem	Points Possible
1	6
2	4
3	4
4	8
5	12
6	8
7	8
8	14
9	12
10	24
Total	100

1) [6 pts] For each of the if statements below, write the output when x = 10, x = 30, and x = 200 in the table below. If there is no output then write "NO OUTPUT".

```
a)
if x > 20:
    if x < 50:
        print("line 1")
    else:
        if x < 500:
            print("line 2")
    print("line 3")
b)
if x > 100:
    print("line 4")
elif x <= 40:
    print("line 5")
if x > 10:
    print("line 6")
```

	x = 10	x = 30	x = 200
Code a)	**NO OUTPUT**	**line 1** **line 3**	**line 2** **line 3**
Code b)	**line 5**	**line 5** **line 6**	**line 4** **line 6**

2) [4 pts] Write the output of the code below in the box here:

```
sum = 0
for x in range(5, 2, -1):
    for y in range(x):
        sum = sum + y
print("sum:", sum)
```

MY ANSWER:

sum: 19

3) [4 pts] What output is produced after running the following piece of code?

```
A = [5, 7]
B = list(A)
C = A

D = A.append(8)
B.insert(1, 9)
C[1] = 4

print(A)
print(B)
print(C)
print(D)
```

MY ANSWER:

[5, 4, 8]

[5, 9, 7]

[5, 4, 8]

None

4) [8 pts] Suppose we have the following list:

```
happy = [2, [1, [4, 3, 0], 5, 2], [8], 6, [9, 7]]
```

Write the result of the following expressions. If an error is thrown, briefly describe the error.

a) happy[1]	**[1, [4, 3, 0], 5, 2]**
b) happy[2]	**[8]**
c) [9] in happy	**False**
d) 5 in happy[1]	**True**
e) happy[1][1][0]	**4**
f) happy[2][0]	**8**
g) happy[2:4]	**[[8], 6]**
h) len(happy)	**5**

5) [12 pts] For each of the following statements, show what is printed. If nothing is printed then write “NO OUTPUT”.

```
x = 5.0
a = 2

def foo(a, d):
    j = a
    for i in range(a):
        print("hello")
        j = j - 1
    print("world", j)
    print("in foo", dog(j + 1, d))

def dog(x, y):
    print("in dog", y)
    y = x + y
    return y

def cat(a):
    a = a * a
    print("in cat", a)
    return a / 2
```

a) `print(dog(a, x))`

in dog 5.0
7.0

b) `print(cat(x))`

in cat 25.0
12.5

c) `print(foo(a, x))`

hello
hello
world 0
in dog 5.0
in foo 6.0
None

6) [8 pts] Given the following variables that have been defined. What is the **result** and **type** of the following expressions (if it is an Error indicate that, and leave result and type blank):

```
a = 2
b = 100
c = 3.0
snail = "True"
rain = a < b
```

	Result	Type	Error? (yes/no)
`b / a`	**50.0**	**float**	**no**
`c <= a`	**False**	**boolean**	**no**
`snail[a]`	**"u"**	**string**	**no**
`rain and b > c`	**True**	**boolean**	**no**

7) [8 pts] What is the output of the following code? If the code has an error write "**Error**".

```
big = {0, 1, 2, 3, 4}
small = {4, 5}
```

a) `print(big & small)`

{4}

b) `print(small | big)`

{0, 1, 2, 3, 4, 5}

c)
```
element = big.add(4)
print(element)
print(big)
```

None
{0, 1, 2, 3, 4}

d) `print((big - small).remove(5))`

KeyError: 5

8) [14 pts] a) **Draw** the entire environment, including all active environment frames and all user-defined values, **at the moment that the MINUS OPERATION IS performed**. Feel free to draw out the entire environment, but be sure to CLEARLY indicate what will exist at the moment the **MINUS** operation is performed (e.g. cross out frames that no longer exist).

b) When finished executing, **what is printed out by this code**?

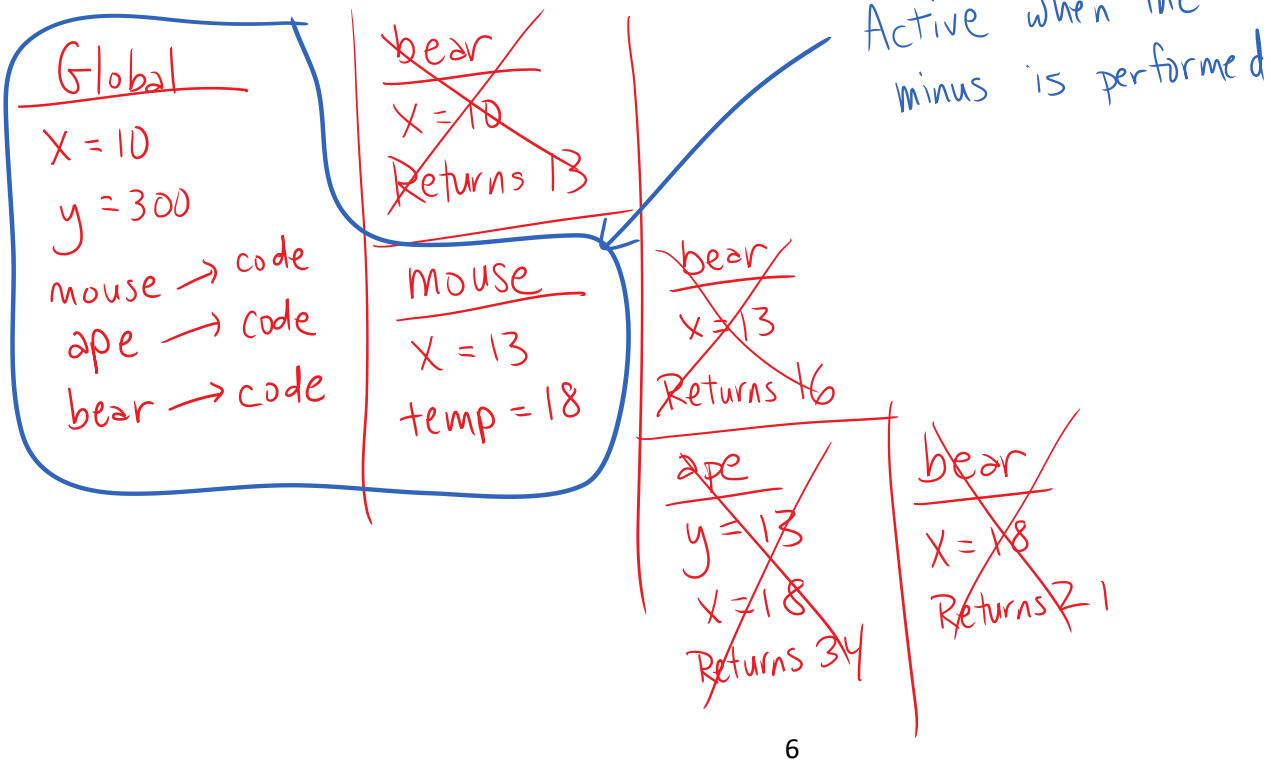
MY ANSWER: 16

c) **How many different stack frames** (environment frames) are active **when the minus operation is performed**? (Hint: The global frame counts as one frame.)

MY ANSWER: 2

```
x = 10
y = 300

def mouse(x):
    temp = bear(x) + 2
    return ape(x, temp) - temp

def ape(y, x):
    return y + bear(x)

def bear(x):
    return x + 3

print(mouse(bear(x)))
```

MY ANSWER:



9) [12 pts] A `matrix` is a list of lists, similar to our `pixel_grids` from HW3, except a `matrix` should be a square (have the same number of rows as columns). For example,

```
A = [[ 1,  2,  3,  4],
     [ 5,  6,  7,  8],
     [ 9, 10, 11, 12],
     [13, 14, 15, 16]]
```

`trace(matrix)` should return the sum of all the entries along the diagonal, from the upper left corner down to the lower right corner. For `matrix` A above, the trace is defined as:

`trace(A)` = 1 + 6 + 11 + 16 = 34

If `matrix` is not a square (the number of rows is not the same as the number of columns), `trace` should return `None`. You may assume each row in the matrix has the same number of entries. You may assume that `matrix` contains at least one row and one column.

```
def trace(matrix):
    # Write your code here
    if (len(matrix) == len(matrix[0])):
        diag_sum = 0
        for row in range(len(matrix)):
            diag_sum += matrix[row][row]
        return diag_sum
    else:
        return None  # Not required
```

10) [24 points total]

a) [8 pts] Write a function `adjusted_pixel(pixel, val)` where `pixel` is an integer representing a single pixel value and `val` is an integer representing the amount that this pixel should be adjusted. `adjusted_pixel` returns `pixel + val`. In addition:

- If `pixel + val` is less than 0 then it just returns 0.
- If `pixel + val` is greater than 255, then it just returns 255.

You may assume `pixel` and `val` are both integers and only their sum needs to be checked to see if it is within the valid range for pixels: (as in HW3, the valid range is: 0 to 255).

The call: `adjusted_pixel(200, 5)` would return: `205`
The call: `adjusted_pixel(250, 60)` would return: `255`
The call: `adjusted_pixel(100, -6)` would return: `94`
The call: `adjusted_pixel(10, -60)` would return: `0`
The call: `adjusted_pixel(300, -100)` would return: `200`

```
def adjusted_pixel(pixel, val):
    # Write your code here

    new_pixel = pixel + val

    if new_pixel > 255:

        new_pixel = 255

    elif new_pixel < 0:

        new_pixel = 0

    return new_pixel
```

10) b) [16 pts] Write a function `adjusted_grid(pixel_grid, amount)` that takes a `pixel_grid` as described in HW 3 as an argument and returns a new `pixel_grid`, with all of its pixels adjusted by `amount`. As in HW3, the valid range for pixels is: 0 to 255. So any pixel + `amount` that goes over 255 will be capped at 255 and any pixel + `amount` that goes below 0 will be set to 0. For example:

`adjusted_grid([[1, 2], [3, 4], [7, 2]], 3)` returns:

```
[[4, 5], [6, 7], [10, 5]]
```

`adjusted_grid([[8, 4], [5, 6]], 250)` returns:

```
[[255, 254], [255, 255]]
```

You may assume that the provided `pixel_grid` contains at least one row and one column and that each row will contain the same number of pixels. Do NOT change the original `pixel_grid`. Your function should return a new `pixel_grid`.

You should call `adjusted_pixel` (the function you wrote for part a) in your solution.

```
def adjusted_grid(pixel_grid, amount):
    # Write your code here


    new_grid = []
    rows = len(pixel_grid)
    cols = len(pixel_grid[0])
    for row in range(rows):
        new_row = []
        for col in range(cols):
            new_row.append(adjust_pixel(pixel_grid[row][col], amount))
        new_grid.append(new_row)
    return new_grid
```